REQUEST FOR RECONSIDERATION

The claimed invention is directed to a process reacting thermoplastic polyurethanes with compounds having isocyanate groups which comprises aliphatic isocyanates having at least three isocyanate groups and aromatic diisocyanates.

Applicants wish to thank examiner Baumstein and supervisory patent examiner Tarazano for the helpful and courteous discussion held with their U.S. representative on August 13, 2008. At that time, applicants' U.S. representative argued the deficiency of the cited references to recognize that a mixture of aliphatic isocyanates having at least three isocyanate groups and aromatic diisocyanates would provide any difference in processing properties. The following is intended to expand upon the discussion with the examiners.

Thermoplastic polyurethanes (TPUs) are well known polymers, whose property profile has been recognized as improvable by introducing crosslinking. Issues as to premature crosslinking as well as a desire for maximum crosslinking must be considered. Simple techniques for introducing a high degree of crosslinking are sought.

The claimed invention addresses this problem by providing a process in which a TPU is reacted with an isocyanate composition comprising aliphatic isocyanates having at least three isocyanate groups and aromatic diisocyanates. Applicants have discovered a mixture of **aliphatic** isocyanates having **at least three** isocyanate groups and **aromatic diisocyanates** to provide for good crosslinking properties which can be achieved simply such as by reacting in an extruder or injection molding apparatus. Such a process in nowhere disclosed or suggested in the cited references of record.

The rejections of claims 1, 2, 4, 8-10 and 12 under 35 U.S.C. §102(b) over Bhattacharyya U.S. 6,142,189, of claim 3 under 35 U.S.C. §103(a) in further view of Sapper U.S. 2003/0032179, of claims 5 and 6 under 35 U.S.C. §103(a) in further view of Porter et

al., of claim 7 in further view of Mark et al eds. and of claim 11 under 35 U.S.C. §103(a) in further view of Enlow et al. U.S. 6,254,712 are respectfully traversed.

None of the cited references suggest reacting a TPU with an isocyanate containing composition comprising aliphatic at least triisocyanate and aromatic diisocyanate.

Bhattacharyya has been cited by the examiner for a disclosure of the claimed "compounds having isocyanate groups" asserting a disclosure of triallyl isocyanate, as well as diphenylmethane 4,4'-diisocyanate and that mixtures of isocyanates and polymeric isocyanates having a functionality of 2.0 or more have been found to be useful.

The paragraph bridging columns 3 and 4, which describes the crosslinking agents is reproduced below:

> The crosslinking agent of the present invention can be any suitable polyfunctional compound which reacts with the reactive sites on the thermoplastic material to crosslink the thermoplastic polymer. The preferred crosslinking agent is an **isocyanate which contains at least 2.1**, preferably more, functional groups which react with the reactive sites on the thermoplastic polymer. Other crosslinking agents may include **peroxides**, e.g., dicumyl peroxide, 2,5-dimethyl-2,5-di(t-butylperoxy)hexane, 2,5-dimethyl-2,5-di(t-butylperoxy)hexane-3, 1,1-bis(t-butylperoxy)hexene-3, t-butylperoxybenzoate, and the like; **polyols** such as aromatic and cyclic polyols, e.g., hexafluoroisopropylidene-bis-(4-hydroxyphenyl) hydroquinone, isopropylidene-bis-(4-hydroxyphenyl), etc.; **polyamines** such as hexamethylenediamine carbamate, alicyclic diamine carbamate, dicinnamilidene, hexamethylenediamine, and the like; **cyanurates** such as triallyl **cyanurate** (TAC); isocyanurates such as triallyl isocyanurate (TAIC); and the like; **polymeric isocyanates and diisocyanates**, such as diphenylmethane-4,4'diisocyanate (MDI). Crosslinking agents containing at least two and preferably more than two functional groups such as TAC, TAIC, isocyanates, mixtures of isocyanates and polymeric isocyanates having functionality of more than 2.0 are found to be particularly useful. **The isocyanate reactant is preferably a polyisocyanate, i.e., the isocyanate has a functionality of at least 2.1 and preferably greater than 2.1 for crosslinking to happen.** In the thermoplastic polyurethane, the functionality must be at least 2.1. Typically, the crosslinking agent will be added to the vulcanizate in an amount of about 1 to 10% and preferably about 1 to 5% by weight, based upon the weight of the vulcanizate.

At best the reference describes using a mixture of isocyanates and polymeric isocyanates having a functionality of at least 2.1. The implication from the reference is for the isocyanates to be of the same type, albeit of differing functionality. There is no

description of using a combination of **aliphatic** at least triisocyanate and **aromatic** diisocyanate. Thus while the reference may suggest a mixture of diisocyantes and at least triisocyanates, there is no disclosure or suggestion to provide the at least triisocyanates as aliphatic isocyanates and the diisocyanate as aromatic isocyanate.

In contrast, the claimed invention is directed to a process in which TPU is reacted with compounds having isocyanate groups comprising **aliphatic at least triisocyanate** and **aromatic diisocyanate**. While not wishing to be bound by any particular theory, the aliphatic isocyanate groups are less reactive than the aromatic isocyanate groups, allowing for no, or only a very slight, molar mass increase due to crosslinking by way of urethane bonds derived from triisocyanates. This allows for suppression and elimination of blockage in the extruder or in the injection molding apparatus. (pg 2, lines 22-33 of applicants' specification) The specification examples demonstrate effective crosslinking in a simple apparatus such as an extruder.

As Bhattacharyya fails to disclose or suggest having a mixture of aliphatic and aromatic isocyanates nor any benefit from the combination, the claimed invention is clearly not rendered obvious from this reference.

The remaining references fail to remedy the basic defects of the primary reference.

Sapper has been cited for a disclosure of a crosslinking polyisocyanate having a functionality of from 2 .5 to 5 and a viscosity of from 100 to 10,000 mPas, but fails to suggest compounds having isocyanate groups comprising aliphatic at least triisocyanate and aromatic diisocyanate.

Porter has been cited for a disclosure of a poly(propylene oxide) polymer of an equivalent weight 1,000 to 5,000 used in the preparation of polyurethane and/or polyurea elastomers. However there is no disclosure of crosslinking with compounds having isocyanate groups comprising aliphatic at least triisocyanate and aromatic diisocyanate.

Mark has been cited allegedly for a disclosure of a mixture of aliphatic and aromatic isocyanates as well as for increasing the average functionality, citing page 254. However there is no disclosure of crosslinking with compounds having isocyanate groups comprising aliphatic at least triisocyanate and aromatic diisocyanate.

Enlow et al. has been cited for using extruders to process thermoplastic resins, but there is no disclosure of crosslinking with compounds having isocyanate groups comprising aliphatic at least triisocyanate and aromatic diisocyanate.

As the cited references fail to disclose or suggest crosslinking with compounds having isocyanate groups comprising aliphatic at least triisocyanate and aromatic diisocyanate, the claimed invention is neither anticipated nor would have been rendered obvious by the cited references and withdrawal of the rejections under 35 U.S.C. §102(b) and 35 U.S.C. §103(a) is respectfully requested.

Applicants submit that this application is now in condition for allowance and early notification of such action is earnestly solicited.

Respectfully submitted,

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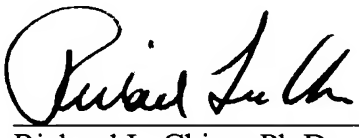

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